



EM4919E

# Timothy Hay

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Timothy is an introduced cool-season grass that is very winter hardy but lacks heat and drought hardiness compared to many other hay grasses, mainly because of shallow, fibrous roots. Like other C3 (cool-season) grasses grown in the region, mature timothy plants produce roots in the fall and spring. During the winter and summer they shed much of the previously developed, short-lived root system. Research from Great Britain reported about 80 percent of timothy roots are found in the top two inches of soil, although roots will extend beyond two feet. If properly managed through a drought period, timothy roots will grow deeper by shifting more water to root cell elongation at the expense of top growth. Seedling timothy produces new roots for most of its first year.

The objective of this paper is to provide practical management recommendations to timothy producers based on the crop's growth and energy storage requirements. This information will help growers produce timothy with reduced water supplies and help the crop survive in drought conditions.

## Energy Storage

Timothy is unique among grasses in that during the autumn it develops a corm, which is a bulb-like structure, from an elongated internode. Water soluble carbohydrates, mainly fructans (chains of fructose sugars with a terminal glucose sugar), fill the corm until after the flowering stage in the spring. Fructan concentration then declines in the seedhead stem as starch content increases in the seedheads. Very little fructan is stored in the seeds at crop maturity, since starch is the primary storage carbohydrate in the seed. Highest fructan concentrations are found in stem bases (the region from soil surface to approximately 3" above the ground) and the corms. Fructans molecules are stored in the

vacuole of cells and vary in length and size, depending on the grass species. Fructans are produced from sucrose (common table sugar) during photosynthesis and can be created any time of the day or night. Timothy fructan molecules are larger than those in other cool-season grasses and actually more resemble those of onions.

## Management Keys

Weakened timothy stands may decline and die during a prolonged drought. However, there are important management keys that will improve the potential for satisfactory yields and survival. Factors that can improve yields and reduce stand losses are (1) maximizing root growth and (2) ensuring high levels of carbohydrate reserves in the crown (stubble) and corm. Proper fertilization and harvest management are the most important management keys to producing a marketable first cutting and sustaining the current stand through drought conditions.

### *Proper Fertilization*

Adequate levels of phosphorus (P) and potassium (K) fertilization are necessary for root and shoot development. Spring green-up will be earlier for timothy fertilized in the fall. Fall-fertilized timothy has greater rooting potential during the spring of a drought year, thus a better chance for summer survival. If you do not fertilize in the fall, your crop will still benefit from fertilization in late winter or early spring. To maximize spring root production, obtain a soil sample from each field and fertilize with P and K accordingly. These roots will absorb water and minerals from the soil so the plant grows to its potential in the early spring growth period of a drought year. Apply nitrogen at a level sufficient for the first cutting's yield, likely no more than half your normal N rate. In the fall, post-drought, or

when rains return, soil test again and apply the recommended amounts of P and K. A limited application of N and S in the fall will also help the crop grow during this period.

### ***Proper Harvest Management***

Following a good pre- and post-harvest management plan will improve chances of producing a marketable first cutting hay crop while sustaining the current stand through the drought. Proper P and K fertilization helps early growth produce more tillers and fill the plant with life-saving, stored fructan sugars. Be prepared for an earlier than normal first cutting harvest in a drought year. Drought will hasten the spring development of timothy, with first cutting one to two weeks earlier than normal.

Do not graze or cut the crop at boot or earlier, as this will shorten the period of fructan storage in the stubble. Harvesting at flowering or later will ensure good carbohydrate storage. A more mature crop will be drier than normal and may not take as long to dry in the windrow. Delaying harvest until maturity will likely reduce the export quality of the hay.

When harvesting, leave four to six inches of stubble. This higher than normal stubble height will help save the stand through the hot, dry months. Taller stubble ensures more fructan sugars to feed the growing points (located at or below the soil surface). Taller stubble will shade the soil surface, lowering soil temperatures and increasing plant survival rates.

Without continued irrigation, timothy will go into a state of dormancy before or after first cutting. If irrigation water is limited after the first cutting, then refrain from irrigating and stimulating new regrowth. Second cutting regrowth will mobilize stored fructans as it attempts to produce a second hay crop. Reduced fructans weakens the plant, making it more susceptible to drought-induced death. Do not be tempted to graze the taller, residual stubble. Timothy regrowth and stubble, after first cutting, will be high in fructan sugars needed by the plant for the survival period. Timothy should remain dormant until the drought has passed; it likely will survive this interruption in its normal cycle.

If the drought continues from spring to early summer, gradually reduce the amount of water with each irrigation application to prolong the spring rooting growth. As plants become water stressed, they will grow more slowly and the leaves will wilt. Fructan accumulation will likely decline but proline leaf concentration will increase. Proline, which has been found in many grasses, including cereal grains, provides partial plant protection during drought periods. Proline concentrations will decrease within 48 hours after irrigation or rainfall. If this event is followed by another prolonged dry period, stand losses are likely.

Spring growth and thus the first cutting yield will be lower than normal during a drought, depending on previous timothy management and current irrigation water availability. Weakened plants with low carbohydrate reserves are not likely to produce seedhead tillers at this time. Tillers will remain vegetative throughout the spring and summer. If timothy is harvested for hay before or at the boot stage, the crop will be severely stressed.

During drought conditions, timothy stands will decline or die, because the corms lacked time to fill and stubble lacked adequate time to store fructan sugars. All classes of livestock and farm machinery, including sprayers, should be kept off the timothy fields during the drought period as the plants are very delicate.

### ***Forage Quality***

Drought-stressed timothy hay and its regrowth will have higher than normal forage quality. Whole plants, leaves, and stems will all exhibit lower ADF (Acid Detergent Fiber) and NDF (Neutral Detergent Fiber) but higher protein. Timothy will accumulate nitrates in the hay, however, so drought-stressed hay should be tested in a laboratory for nitrate concentration.

### ***Weed Control***

Weeds always compete with hay for water and nutrients. In addition, drought-stressed plants may respond adversely to certain pesticides. Carefully read pesticide labels. Additional product information may be obtained from company representatives. Some phenoxy herbicides will stimulate plants to increase nitrate storage in tissues. High plant nitrates are an animal health

concern in drought-stressed forages. Be sure that any suspect timothy be tested for nitrates in a laboratory. If drought-stressed timothy is used for pasture, you will need to test it to make sure it is safe for grazing.

### ***When Rains Return***

Timothy leaves monitor day-length, signaling the plant to regrow fall roots and new growing points for the next year. After a severe drought, timothy can withstand a harsh winter better than other grasses. However, fall management is critical to avoid thinning of the timothy stands during fall and winter. Growers will need to prepare the timothy crop for the following year's normal cycle of growth and production as described in this bulletin. Drought related research is very limited on timothy hay grown in the Pacific Northwest or worldwide. The concepts in this paper have been extracted from numerous sources.

Information on soil moisture monitoring and crop evapotranspiration from Washington's Public Agricultural Weather Stations (PAWS) and Washington Irrigation Scheduling Expert (WISE) are available on the Scientific Irrigation Scheduling (SIS): web page  
<http://sis.prosser.wsu.edu>

Drought advisories and other Washington State University Extension Bulletins are available online at  
<http://pubs.wsu.edu>  
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By Steve Fransen, Extension Agronomist, Washington State University Prosser Irrigated Agriculture Research and Extension Center (WSU-IAREC) and Tipton Hudson, Extension Educator, Washington State University Extension, Kittitas County.

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